ENERGOPTIONS

OVERVIEW PAPER

WOOD RESIDUE BURNING

for Space and Water

Heating

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1. INTRODUCTION

Many industrial, commercial and institutional establishments with significant space and water heating demands can cost-effectively meet their needs by substituting wood fuel for oil and, in some cases, electricity. Wood fuel substitution is even more cost-effective in some industrial processes which use heat and steam. Hospitals, nursing homes, schools, office buildings, apartments, industries and greenhouses have all proven to be well-suited to the application of this technology. The viability of switching to wood depends on a local and assured supply of wood or wood residues, often from sawmills, other wood products or forest harvesting operations. Where this condition can be met, the economics and reliability of wood fired boilers are very attractive.

Valuable lessons can be learned about these technologies from projects supported under the Conservation and Renewable Energy Demonstration Agreements (CREDA), the Forest Industry Renewable Energy (FIRE), and the Bioenergy Development (BDP) programs in companies and institutions across Canada.

2. WOOD FUEL PROJECTS

The projects outlined below cover the application of wood burning technology to a wide range of users in locations from the Yukon to Newfoundland. A more detailed description of each project is provided in the ENEROPTIONS Case Studies in this package.

ONT 48 Automatic Wood-Fired Boiler - Grenville Christian College, Brockville, Ontario

A large automatic wood-chip boiler was installed at Grenville Christian College to provide all space heating and hot water requirements. The savings realized by the college are $75,000 per year. They have planted poplar to provide for their requirements in perpetuity.

NB 54 Wood Residue Fuelled Boiler - University of New Brunswick, Fredericton, New Brunswick

A large wood-fired boiler was installed, under an innovative savings financing arrangement, at the district heating plant which serves the entire UNB-Fredericton Campus, two apartment buildings, and a large hospital. Annual operating savings in the range of $820,000 are being realized as the contribution to total heating requirements is over 70%.

NWT 21 Wood Heating of Fort Smith Water Supply - Fort Smith, N.W.T.

The town's water supply is now heated by an automatic-feed wood-fired hot water boiler unit. Fuel wood for the boiler is harvested locally creating a new industry and new jobs. The project resulted in the displacement of 160,000 litres (35,195 gallons) of fuel oil in its first year and is expected to displace approximately 200,000 litres in subsequent years.

ONT 34 Energy from Wood Waste - Foothill Greenhouse Ltd., Kettleby, Ontario

A system which burns wood chips and sawdust provides all heating requirements and results in energy savings of $46,580 annually by replacing oil. Heating, ventilation and humidity are controlled and monitored by a microcomputer, which reduces

manpower needs.

NFLD 31 Wood-Chip Heating - Newfoundland Hardwoods Ltd., Clarenville, Newfoundland

An asphalt and creosote plant replaced its oil burning system with a medium-scale wood burning system. Approximately 1,365,000 litres (300,000 gallons) of oil have been displaced resulting in an annual savings of $118,800.

NB 10 Modifications to Wood-Chip Boiler - Maritime Forest Ranger School, Fredericton, New Brunswick

The existing wood-chip boiler system was modified and updated to improve efficiency, reliability and safety and to expand the range of cull wood it could use. Wood costs have thus been cut by 65% per year.

NB 22 Wood-Chip Burner - Brookdale Nurseries, Newcastle, New Brunswick

Wood chips are now being used to fire boilers originally designed for oil at the Brookdale complex which includes greenhouses, retail display area, farmers market, office, maintenance and stock areas. Annual savings of $30,000 in fuel costs have been realized.

YUK 17 Pelly Crossing Wood-Chip Furnace Project - Pelly Crossing, Yukon

Space heating and domestic hot water for the community's new 1,300 m^2 (14,000 ft^2) school is provided by an automatic-feed, wood-chip boiler. Fuelwood for the boiler is harvested locally. Savings are $11,425, or 60% of the cost of operating a conventional, oil-fired system.

NFLD 3 Hospital Wood-Fired Boiler - Gander, Newfoundland

A 160-bed hospital saves $100,000 annually by using wood residue in a Canadian wet cell burner.

QUE FIRE Sawmill Wood Residue for Lumber Drying - Beloeil, Quebec

A Quebec sawmill saves over $100,000 and 830,000 litres (182,500 gallons) of oil a year by using their sawmill residue to heat their lumber drying kilns, thus solving both energy and waste disposal problems.

BC BDP Reliable Biomass Bin-Feeder - BCR/UKAF, Vancouver, B.C.

To eliminate flow stoppage, a major problem in the use of biomass residue fuels, B.C. Research has designed a bin feeder system that has close to half the capital costs and less than one-third the operating costs of conventional storage and recovery systems.

Many other wood burning projects have been undertaken. Contact your nearest federal or provincial energy office to learn more about nearby projects or those applications similar to yours.

3. LESSONS LEARNED

All of the above projects demonstrated the direct combustion of wood, usually in the form of wood chips, in a boiler to provide hot water for space heating and water heating purposes.

Important lessons were learned, especially with respect to quality control and ensuring that all system components are in place.

Payback Period. The demonstrations showed that the burning of wood is a very cost-effective alternative to the use of oil for heating purposes. Payback periods for conversion to wood-fired boilers amongst the CREDA projects range from 3 to 12 years.

Quality Control. Careful control of wood fuel quality is essential to high efficiency and low maintenance costs. Contamination of fuel by soil, stones, glues, coatings, nails, or excessive moisture content can cause handling, combustion and emissions problems. Excess clinker build-up has been a problem in some installations. This can probably be corrected by improved fuel quality control (i.e., fewer contaminants) and a slight over-firing of air. Creosote build-up in dust collectors and stacks has also been experienced, especially at low-load and when fuel moisture content is high. This can often be reduced by excess air and higher capacity operation.

Emissions. In converting from oil to wood, sulfur dioxide emissions cease, but oxides of nitrogen and particulates may increase. If the design includes induced draft, ash scrubbers and separators and if the burn is properly regulated, fewer pollutants are emitted from wood than oil. The production of polycyclic hydrocarbons is also an area of concern and debate but more in relation to damped-down residential wood stoves.

Fuel Handling Systems. Materials handling systems (conveyors, storage bins, augers, feeders, etc.) are probably the most trouble-prone part of the system and require careful attention to their design, operation and maintenance. Uniform fuel - size, shape, moisture content - is especially important to efficient materials handling, which can in turn affect choice of equipment and thus cost.

On-site Storage. Sufficient on-site storage capacity is required to cover periods of peak demand and possible problems in the supply line. Generally, this is a maximum of four days for industrial operations.

Operation and Maintenance. Wood burning boilers require more maintenance and closer attention than oil-fired systems which may mean higher labour costs. These are usually offset by lower fuel costs.

Ash Disposal. An advantage of using residue fuel is that it leaves minimal ash, though disposal must also be considered. Collection and tipping fees should not be overlooked.

4. NEXT STEPS

If you are considering an alternative heating system, it is important to take the following steps:

- assess your heat requirements in terms of seasonal duration, temperatures, peak loads, and cost and practicality of alternatives;

- arrange for a long-term reliable supply of wood, wood residue, wood chip or sawdust fuel and obtain a written guarantee of delivery and price, at the same time ensuring that you have sufficient flexibility to capitalize on short term options;

- locate a consultant and contractor experienced in woodburning systems who can provide information on wood storage, feeding and burning equipment and who can accurately size the equipment for the reduced heat load after application of cost effective conservation;

- where capital cost of the system is a barrier, consider a savings financing arrangement whereby an outside party finances the costs and is repaid out of the institution's savings over a period of time. Such arrangements can also include operation and maintenance of the equipment. The other party is often either the consultant, equipment supplier or fuel supplier.

5. RESOURCES AVAILABLE

Technical reports are available free of charge for most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS case studies under the "Further Information" section.

The departments or ministries of energy in each province or territory have information on energy conservation and renewable energy and may have assistance programs. Check your telephone directory for appropriate contacts.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on converting to wood, such as technical bulletins, data bases on projects, equipment suppliers and wood availability as well as on demonstrations and other assistance programs. Check the back of the attached file folder for the office in your area.

Information on qualified engineering firms by area of specialization and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services" can be obtained from:

(a) The Association of Consulting Engineers of Canada
Suite 616
130 Albert St.
Ottawa, Ontario
K1P 5G4
(613) 236-0569

(b) The consulting engineering organization in your province.

Information on innovative financing arrangements may be obtained through the government sources listed above or by contacting:

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(Re: ENEROPTIONS)
Energy Management Advisor
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resources Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
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